

AERONAUTICS RESEARCH ADVISORY COMMITTEE (ARAC)

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Summary Minutes

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G Michael Green, Executive Director

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May 3, 2005

Opening Remarks—G Michael Green

Mr Green, Executive Director of the Aeronautics Research Advisory Committee (ARAC), called the meeting to order at 8:40, noting that the next ARAC meeting would be held jointly with REDAC and is scheduled for September 20–21. Everyone introduced her/himself. Mr Jamieson explained that the purpose of this meeting is to review where we are and where we're going with the new Administrator, Dr Michael Griffin.

Aeronautics Research Mission Directorate—J Victor Lebacqz

Dr Lebacqz set the stage for the meeting by reviewing what he knew of Dr Griffin's perspective—very direct with a clear agenda, technically experienced, and not very political. Under Dr Griffin, the NASA Advisory Council's (NAC's) function will be truly as an advisory committee to him. He is committed to return to flight, and the decision to delay flight from May until July will give him a chance to meet with other divisions. He is a strong believer in the Vision for Space Exploration and he is supported by Senator Mikulski, which means he will probably want to extend the life of the Hubble, and not with a robotic mission. At his confirmation, Dr Griffin talked about how, in the Apollo era, NASA was not just a single-mission agency, and he wants to get back to that. Furthermore, the budget now is equivalent to the budget then, and he sees no reason why NASA can't pursue those programs as it did then.

National Policy for Aeronautics

The Aeronautics Research Mission Directorate (ARMD) provides national leadership for aeronautics technology to industry, NASA's other missions, other government agency partners (especially the Federal Aviation Administration [FAA] and the Department of Defense [DoD]), and universities. The reviews NASA has received from the National Research Council (NRC) and the Office of Management and Budget (OMB) indicate that the Agency has been doing too many things and should be working on more high-risk, high-payoff technologies.

Aeronautics research is divided into 3 programs—Aviation Safety and Security, Airspace Systems, and Vehicle Systems. Although the budget is being reduced, priorities remain the same: to ensure NASA's contribution to the Joint Planning and Development Office (JPDO)—a congressionally mandated collaboration of NASA, FAA, DHS, and others—to make it work (\$5 million to \$10 million is directed to maintaining the office, and \$200 million for research); to emphasize public-good research, eg, aviation safety and security, reducing noise and emissions; to focus more on uninhabited aerial vehicles (UAV); to assess possibilities for supersonics, especially quiet supersonics; to increase planetary

aircraft research that can fly on other planets; and to define high-risk innovative technology to maintain US leadership in aerospace. The President's budget for fiscal year 2005 was reduced, and in FY2006 was reduced by \$100 million beginning in 2005. By 2007/2008, the budget would be down \$200 million, reflecting major changes in the Vehicle Systems program, which is not sustainable under this budget line, despite the program's receiving a very high approval rating and nearly a national consensus. It will be a different program. The other 2 programs remain more or less unchanged.

Since the President stated his Vision for Space Exploration (January 14, 2004), the Agency has been undergoing a transformation to try to meet that Vision, as well as his management agenda of competitive sourcing, and responding to the Aldridge Commission's recommendations and assessing the Agency's core competencies. Langley is the first to go through an A76 review process. There is a disconnect between the bottom-up vs top-down perspective (what can be offered vs what the Agency thinks it needs). Dr Griffin thinks roadmapping is taking too long and has called for the roadmaps' completion by the end of this month.

Since the mid-1990s, the Aeronautics Research portfolio has gone more toward public-good technologies—air traffic management, safety, security, and environment—and not performance. It has gone from technology R&T to barrier-breaking demonstrations, and increasing use of competition through merit-based research selection. They are still trying to reach the right balance of competition for civil servants, and they need to find a way to do that while considering intellectual property rights. The only way to justify hiring civil servants is to have them win competitions.

The Vehicle Systems program budget was reduced by \$100 million in 2006 and by \$200 million 2007, about 40%. Research was first discipline-based—research could lead to several vehicles. Focusing the remaining research dollars on things they think can make a significant difference and are arguably beyond the scope of industry, they settled on 4 projects and their justification: subsonic noise reduction, sonic boom reduction, zero emissions aircraft, and high-altitude long-endurance (HALE) aircraft. In addition, they will add a new program—Foundational Research (~20% of the portfolio)—which will have ~\$25 million (ie about 20% of cost to running NASA wind tunnels) to deal with wind tunnel issues in partnership with the Air Force via NATA. They will begin by sorting out a hierarchy of wind tunnels. A percentage of this program will be devoted to university research, independent of the other 3 programs. They don't want university work to be cut with the next budget cut, but they want universities to be part of the teams (2% of all programs; 10% of this program). They invited universities to suggest ideas.

Four centers (Ames, Dryden, Glenn, and Langley) account for some 3000 civil servants. The 40% reduction in the 2007 Vehicle Systems budget will necessitate laying-off some 800 people. And, merit-based selection could reduce support for civil servants even further. To be terminated in 2006 are UEET at GRC (which is being eliminated because of earmarks; about 30% of the budget had been targeted to this center), and Advanced Aircraft Program (a classified program).

Ground test facilities are divided into 5 categories: I, substantial projected NASA program usage and assumption of national stewardship (\$12.5 million in fixed costs); II, NASA/DoD/industry projected usage (\$5.4 million in standby costs); III, not required but desired as part of a robust capability (\$0.5 million in “mothball” costs); IV, not required and will not be retained (\$0 million); and V, laboratory facilities to be sustained locally (\$0 million).

The National Institute of Aerospace (NIA) studied national aviation needs and finished their report about a month ago. This was not NASA led, but congressionally directed via a \$5 million earmark. They identified specific national needs—US economic competitiveness, freedom of air travel, flight safety, a secure and well-defended nation, environmental protection, and education of the future workforce—and plotted them against specific milestones and timelines. The report is to be released today and will feed into the national policy.

Inserted into Dr Lebacqz’s written testimony before the House Authorization Committee was a paragraph about the 3 or 4 sides of aeronautics policy, namely that aeronautics is a mature technology engaged in an international competition. It involves high-tech area in which countries have a niche and in which the United States had the lead. If we want to regain that lead we need to have a dialogue that leads to a national policy, and this year, Congressman Wolf will call for NASA to engage in this dialogue.

We have the NIA study document (which says, this is what you should do and it will cost about \$2 billion); and we have results of the roadmapping activity (which says, for the amount of money allotted, this is what you can do). Government policy should be addressing competitiveness. National Science Technology Committee (NSTC) undertook an inter-agency study to develop a policy proposal with its possible ramifications; their report is due at the end of July. ASEB will begin a Decadal Survey of Aeronautics, which will develop and assess policy options; that report is due at the end of the year. Dr Lebacqz would like ARAC to continue to work on roadmapping to identify things that should be done. All these reports would coalesce toward the end of November when the 2007 budget is passed back.

Discussion

Mr Boccardoro noted that NASA centers compete among themselves for work done in-house, but it is unsettling to think that industry may also be competing for this work. Dr Lebacqz said that would not be the model. The model would be collaborations formed among NASA centers, industry, and academia (eg, Langley, Purdue University, and Northrop Grumman). The difficulty is intellectual property issues. They may have to engage in foundational research to justify that the number of civil servants is appropriate because they are the best people to do this research. In response to Dr Katehi’s question, Dr Lebacqz said that, by comparison with other directorates, Aeronautics Research hires about a sixth of NASA’s civil servants and uses about 5% of its budget.

Dr Harris said that according current political philosophy, competition, by definition, is good and will bring out the best; to keep people on their toes, they need to be challenged occasionally. Nevertheless, Dr Lebacqz added, at some point (eg, after 3 years), when you decide you can't progress any further, someone else should be able to bid on that research. Dr Gellman identified the problem that, in Europe, research results are kept secret and proprietary, but here we give them away. Dr Lebacqz replied that whether research should be closed or open will be included in discussion of the appropriate role for government R&D, as will competition.

An Aerospace Commission (chaired by Bob Walker) discussed things that should be done, but no one supported their decisions. The NRC study identified many things that should be done, but included no policy statement as to why it is appropriate for government to do these things. A policy statement would enable NASA to do the things everyone says it should and would enable NASA to change direction. (Mr Boccardoro noted that the absence of a policy is a policy, and whoever is last in line makes the decision.) For instance, Dr Lebacqz said, ARMD, not the centers, will be responsible for strategic management of wind tunnels. Mr Anderson said that Rich Ancliff had suggested that one person be assigned to manage and be responsible for each wind tunnel.

Dr Lebacqz noted that the country has a huge deficit problem, and budgetarily NASA fared better than other agencies. He explained that for the FY2007 and 2008 budgets, ARMD tried to make the Vehicle Systems program so clear and compelling—folding into the program every piece of advice—that anyone would declare it important, relevant, and appropriate. About 5% of the entire NASA budget is designated for ARMD, but Dr Lebacqz thinks the ARMD budget is now at bottom. The budget for JPDO (which Congress mandated) amounts to \$10 million of a total of \$200 million. A lot of the work is based on helping FAA and industry reduce emissions and noise (UEET was research on the pollution part of subsonic noise), but reduced work in this area has caused perturbations. The NASA budget of moneys going outside has ranged from 1 to 9%, which would probably be a higher percentage if personnel were included.

The point at which you cannot turn back with the budget and a reduction in force is a central issue. If the \$100 million were returned to ARMD, that still would not solve this problem because many non-aeronautics people are involved. Without a new plan and focus to justify retaining all these people, the issue would re-emerge for the next budget cycle. If the money were returned, it would be spent on restoring worthy programs, but that would not necessarily mean keeping the status quo. To sell new programs a directorate must go to the Administrator, OMB, and Congress, in that order. Dr Lebacqz briefed OMB on the revised mission program before pass-back and after. The four programs plus Headquarters-led projects for facilities were laid out and all were accepted. They understand Foundational Research and the rest. OMB has not been negative about the other two programs. The new Administrator has said the Agency had a robust aeronautics program during the Apollo era and he supports that, but we do have budgetary constraints. Dr Lebacqz believes there should be a policy that helps develop and drive that.

Dr Katehi noted that civil servants have accumulated a lot of knowledge, and losing them could harm programs, including university programs. Dr Lebacqz pointed out that the new Foundation Research program identifies the need to have the best people. But, ARMD has \$200 million less, which translates to a reduction of about 800 people (the hardest part of all of this, and a part the Agency hasn't quite grasped yet, e.g., options or cross-training of personnel to be laid-off have not been offered). JPL and CalTech have programs in place that are supported from both sides, and this might be a good model to emulate. Dr Lebacqz has looked at this option for facilities, but not for the people. Ohio talks about the state taking over the facilities in return for NASA promising to use them. NASA must show that it requires the competencies at the centers; there aren't that many people who can do these things.

Dr Gellman related that, in Europe, they talk about R&T as a EU-wide asset. He suggested that NASA use the word "national" more often in their explanations and justifications. As to whether Foundational Research will be applied or basic, Pasteur's Quadrant relates to use-directed basic research, that is, basic research to solve a particular problem. Dr Lebacqz's personal preference is for the Foundational Research program to follow these lines.

The vision for education in universities to prepare the workforce for the future is being implemented through research and through undergraduate study. NASA has initiated Explorer Schools (a K-12 program involving 100 or 150 schools that receive NASA support), and is about to initiate a scholarship-for-service program to provide 4-year tuition to competed students, in return for 4 years' work afterward, and summer internships. Within ARMD, they started the Council of Deans to tell ARMD what's wrong with the way NASA does business, but also so ARMD can tell deans what's wrong with curricula—this must be a 2-way dialogue to ensure that educational opportunities are consistent with current programs.

The President has said we'll have hydrogen-based energy, which means electricity. All the things you do to advance these technologies will have downstream payoffs in other things, eg, the advanced-core engine. Dr Hansman suggested the need for more work on the notion of structuring against the President's R&D criteria.

[During the meeting, Mr Anderson asked for a revised ARMD organizational structure; the new chart was distributed later in the meeting.]

Update on Next Generation Air Transportation System—Robert Pearce

The National Integrated Plan for aeronautics, presented to Congress in December 2004, establishes national goals, sets the context and direction for transformation of the air transportation system, and creates a governance model for a multi-agency cooperation. The Joint Planning and Development Office (JPDO) is a small office established to oversee development and implementation of that plan.

Most of the organization supports a master Integrated Product Team (IPT) function in collaboration with another agency. There are 8—Airport Infrastructure (FAA), Aviation Security (DHS), Air Traffic Management (NASA), Situation Awareness (DoD), Environmental Protection (FAA), Weather (DoC), Global Harmonization (FAA), and Safety Management (FAA). What each is doing is detailed in the report.

The Next Generation Air Transportation System (NGATS) Institute was recently created to facilitate private sector work with NASA. They plan to have the executive director sit on the Master IPT; a Senior Policy Committee executive from each agency will work on budgetary issues; and the IPT will meet weekly with the REDAC Executive Committee.

The JPDO 3-year outlook takes the transition to a national plan from planning (beginning FY2005) to implementation (by FY2007). It must be affordable and finance-able. To have a funded portfolio in 2007, those programs must go to the Administrator in 2005. In the near term, IPT must articulate what they need from the agencies. In May and June, work will begin with agencies to get preliminary commitments, which will become final after the agencies make final budget decisions in September. A draft of the entire plan should be ready by mid-August for OMB review. Then the plan can be adjusted accordingly and aligned with the President's budget.

The idea of integration is critical to moving from policy level to technology level. Finding overlap in integration with agencies will be the challenge, however the Enterprise Integration Service architecture system is working, having benefited from Raytheon's R&D. The NGATS team is building a range of operational scenarios to drive the models. In the IPT, they want to hear the customers' voice and they want the experts' participation. Such private sector involvement is being achieved through the Federal Advisory Boards and the NGATS Institute (seeking to achieve "badgeless" collaboration with the private sector). The institute will fund discrete studies with multiple contributors to a level of \$5 million per year. The aim is to generate industry convergence and support of NGATS solutions and to make NGATS architecture an open tool for the community. The activity began by generating the core concept of satellite-based navigation aids and communication. For this, the NGATS team is trying to get global capabilities to tie into required total system performance to create a scalable system that would respond to demand. Airspace would be dynamic, based on 4-D trajectories and network-centric information. All aircraft would be addressable and could serve as communication links. The team is identifying research required to make the concepts that lie behind it real, and institutional issues that come into play. For current info see: <www.jpdo.aero>.

Discussion

Mr Pearce assured Mr Wilke and Ms Bauerlein that NGATS is engaging OMB so they will champion the NGATS proposal. They are doing this by sending quarterly reports and spending time explaining and getting their buy-in. It's difficult to share at that level, but the budget has shown support.

The IPT will draw from 6 agencies to form a multi-agency team. One role of the institute is to bring the private sector into the IPT, eg, NCAT (the National Center for Advanced Technology), as well as representation from ALPA, GAMA, and AIA, etc.

Ms Bauerlein said that the FAA has to complete a departmental review, which goes to the Office of the Secretary for review. This has already been done for the 2007 budget, but, Mr Pearce said, if we don't assess current programs for the 2005 budget, we will be in a weaker position when going to OMB. A specified amount from the FAA budget goes to NGATS, and the FAA budget was changed to accommodate JPDO. Of the \$10 million to run the office (not to do the studies), \$5 million comes from NASA and \$5 million from FAA.

Mr Swanda thought systems integration is a big issue. Mr Pearce agreed, saying that the idea is to use the enterprise architecture as the core, and next year, NGATS will hire a dedicated contractor for systems integration, perhaps with the offer that, if they manage the architecture, they can use the institute as a research arm. Mr Anderson thought we couldn't wait another 3 years to think about implementation—we need to know who's going to do the technology and who will lead it, but Mr Pearce thought the best we can do is get a reasonable plan to the Administrator to be funded, and have a recommendation for the implementation process. By the end of June, implementation costs should be available and research requirements should have been laid out. That plan goes to the Senior Planning Commission and then to OMB. The next version of the national plan is essentially a proposal. It will be up to the Senior Planning Commission and OMB to decide whether this is critical.

This is the first year Ms Bauerlein has seen people at the Cabinet level trying to move such a proposal forward. Institutional and policy issues are standing in the way, but the technology is available today. Some of the demonstrations are examples of what could be done now. Mr Pearce said the NEO technology is scheduled to be demonstrated in the fall, and the Small Aircraft Transportation System (SATS) is also scheduled in June. The SATS culmination in June will tell what is possible. Dr Hansman added that the IPT is supposed to build-in vetting from the participants—industry, REDAC SEC, NRC. NGATS is laying out decision points, but they have to make a commitment before then or it will be too expensive to change the plan. As decisions come up, Mr Pearce said, they will have to make sure that all the engineering and research has been done to support that decision. They have to identify key decision points and what it will take to get there—e.g., IPT spent a long time identifying all the issues relevant to radar decommissioning—but the issues were so confusing that they stopped trying to do that and moved to

describing a picture of where they want to be in the next 5 years, which they put on a timeline. NGATS is committed to the work to get to the decision point, not committed to a particular research project.

Gen Hoover, said that, in the short term, interface with the rest of FAA is in good shape—the Administrator and the Secretary are involved. Mr Keegan has aligned the Administration and the Agency in a matter of weeks, and things are moving pretty well. Others have seen this basic concept and have not been opposed.

Mr Swanda pointed out that until now this has been a government program, which presents a significant risk. By the time the institute is up and running, people in government will have bought in, but people in industry won't have worked on it, seen it, or bought-in to it, e.g., we need to define the type of ADSP. Mr Pearce agreed that, at that level of detail, collaboration as a community is necessary. NGATS has laid out the issues and when decisions must be made. Over the next 3 or 4 weeks some of these details should be worked out.

Mr Anderson wants to see task assignments, budgets, schedules, risk assessments, fall-back plans. Mr Pearce assured him that the final plan will be available to REDAC in August—before the September ARAC meeting. It will be organizational—NASA will commit this much for that group, etc. JPDO can say what they need and when they need it. Mr Gellman was concerned that JPDO, dealing with the present as well as the future, extend its time horizon to accommodate the national plan. Mr Pearce, agreed: to ensure that what's being done now links with the future, activity is driven by the enterprise architecture and includes JPDO lines of business—everything is in the works, but not completely defined. They are trying to institutionalize NGATS as best they can as they go forward, based on the maturity of the plan (some concepts are not yet mature enough) and the thinking.

DoD is investing heavily in those technologies and are working on getting DoD representatives to serve on JPDO. Mr Swanda feared that airports IPT members may not have the big picture; they seem to think that pouring concrete is sufficient, whereas it would be better to use existing airports more efficiently. It's a question of allocating airport capacity vs providing sufficient capacity for all the people who want to use the airports. Mr Pearce said the view of airports IPT members is that that's the job of air traffic management. They are committed to getting every ounce of capacity out of the existing system, and they have a plan in place to accommodate the future expected demand, which includes where to pour concrete. We don't need to revisit laying concrete, but the systems and technologies that overlay that concrete.

Transformation of the Vehicle Systems Program—Rich Wlezien

The Non-Advocate Review (NAR) of the Vehicle Systems program was conducted October 26–29, 2004. The program passed in all categories—compatibility with NASA policy; clarity of goals and objectives; thoroughness and realism of technical plans,

schedules, and cost estimates; adequacy of management plans; and technical complexity, risk assessment, and risk mitigation plans. The plan remains intact despite budget changes, but they will execute the plan differently than they had intended. If more money becomes available, they know where the programmatic priorities are. Except for JPDO, the Vehicle Systems program relates to all programmatic priorities for ARMD.

The President's FY2006 budget reduction of \$100 million will grow to \$200 million in FY2007 and beyond. The budget has 2 parts—people and facilities, and procurement dollars that can be spent out of house. When budget drops, the only thing that can change is the latter. The challenge is executing demonstration programs that show a larger ratio of procurement to non-procurement than we've had in the past. If the budget were no object, by 2008, the program could complete 3 of the 4 demos (Zero Emissions Aircraft, Subsonic Noise Reduction, High-Altitude Long-Endurance Remotely Operated Aircraft [HALE], and Sonic Boom Reduction). The redirected program objective is to simplify aircraft structure to accommodate ARMD concerns for the environment and science, and the 4 demos are aligned with both. Environmental protection involves 3 aspects: constraining noise within the airport boundaries, minimizing the contribution to smog production, and minimizing the impact on global climate.

For Sonic Boom Reduction, they plan a follow-on demo to show that an acceptable sonic boom can be produced by a properly shaped aircraft. The demo outcome is a regulatory issue. They have to define sonic boom level, show that it can be achieved with a realistic vehicle, and effect that change in the regulations. Super10, an alliance of 10 companies (Boeing, Lockheed, et al) has concluded that sonic boom is the most important environmental effect, followed by high lift/drag, etc. To execute changes in regulations, the project has engaged the CAEP process, which means they have to fly something and have data by 2008. The FAA has been involved in deliberations and policy issues.

Subsonic Noise Reduction is an ongoing activity, its long-term goal being to keep noise within the boundaries of the airport. They are on target within the current budget. They plan 3 demos—2005 (10-dB reduction resulting from advanced chevrons on the nozzle, reduction in fan noise, porous stators), 2006 (5-dB reduction by using continuous descent approach), and 2008 (bypass technology).

Zero Emissions Aircraft, still in the definition phase, is the most controversial and least well defined. Zero Emissions Aircraft demo will test all-electric aircraft using hydrogen fuel cells. Key elements are an all-electric propulsion system, lightweight structures, hydrogen storage, and flight testing. By October they want to have the first review. Earth science missions require new vehicle concepts to fly high for long duration and carry a large payload, and for space missions, particularly Mars, they are looking for vehicles that satisfy those same conditions. Flying over Mars is similar to flying at 100,000 feet on Earth. Ultimately, the goal of this project is to enable a permanent presence in space. HALE will be demonstrated via a 14-day hurricane tracker, which is intended to reduce the effects of hurricanes on the economy (this could be done by 2008). Key elements are autonomous flight, regenerative fuel cells, ultra-lightweight structures, and flight testing. A lighter-than-air (vs fixed-wing) craft would need a large envelope to

get a payload to altitude, which makes it not lighter than air. They need ways to stabilize the shape of these vehicles; HELIOS was over-flexible and was lost. A planetary flyer has to be folded up for years and suddenly unfold and deploy as it enters Mars' atmosphere, and then needs to regenerate power to leave Mars.

The focus is only on electric-drive systems and fuel cells, and they stopped work on the other 2 areas. The program is not changing "what," but "how."

Discussion

Mr Wlezien assured members that, despite the \$200 million budget reduction, they are trying to execute a program, and failing that, trying to get to a place where a program can eventually be executed. You can reduce the workforce or increase procurements.

Dr Hansman noted that, in the United States, the issue is not a sonic boom, but a Mach-1 speed limit. In Europe, there have been complaints about the effect of sonic booms on cows, that is, the startle response results in reduced milk production, etc, which comes to an economic impact. In fact, in the mid-1960s, Mr Kern collected information on structural damage of buildings caused by sonic booms' low impulse effect.

To Ms Bauerlein's and Dr Hansman's concerns, Mr Wlezien replied that noise is fully aligned, but they have pulled back from emissions. But, it should not to be construed that noise is being traded for emissions; they are integrated. All the players have been engaged from the outset to make sure technology and process have meshed. The FAA is committed to NASA's timescale, so NASA's reduced funding will also affect FAA programs. In restructuring, NASA has had to give up some work that the FAA was counting on.

Mr Wlezien said the Vehicle Support program had planned to do flight demos (very expensive) only when necessary, but now the demos have become the centerpiece. The plan is clearly laid out, but it's very high risk, as is the Replanning Safety and Security plan. Vehicle Systems has a declining budget with no chance of any change without more clearly defining what they want to do and why. The Aerospace Systems program will remain the same. Dr Lebacqz will brief the new Administrator on this very thing on Friday. The other 3 require projects demos (note, there is a difference between demos and stunts) and all 3 will be brought in earlier than had been planned. The program had money to get started; the demo is a 50/50 split between technology and demo. While building and flying the 14-day HALE craft, they will be working on things that follow it.

Dr Gellman questioned the linkage between security and safety. Dr Lebacqz agreed that the linkage is somewhat arbitrary. It was a starting point, but why to continue linking them is a good question.

Dr Lebacqz noted that many directors in ARMD are termed "acting" because, although they have gone through the full process, no SES changes can be made within 120 days of

a new Administrator's taking office (a law enacted to protect civil servants from political responses). "Acting" does not reflect on the persons, but on the process.

Aeronautics Research Strategic Roadmap Overview—Terrence J Hertz

Dr Griffin wants roadmapping wrapped up by May 22 (4 months early), but that won't stop all roadmapping activity. The Agency began this effort in January in response to national goals and objectives set in January 2004—namely, to advance US scientific, security, and economic interests through a robust space exploration program. Strategic roadmaps and architectures and capability roadmaps were to be combined to determine human capital and infrastructure needs. Strategic objective #12 states: "Provide advanced aeronautical technologies to meet the challenges of next generation systems in aviation, for civilian and scientific purposes, in our atmosphere and in atmospheres of other worlds."

ARMD is particularly related to Agency strategic roadmaps #3, #4, #8, #11, #12, and #13 (especially #11—"Transform air transportation and enable the next generation of atmospheric vehicles"); and to capability roadmaps #1, #2, #3, #4, #7, #8, #9, and #10. The capability roadmaps are technology-oriented (areas the Aldridge Commission identified as needing work) and need to be integrated with the strategic roadmaps.

Aeronautics research started with 5 objectives, which, with a few adjustments, have been in place since 1997—protect air travelers and the public, protect the environment, increase mobility, partner for national security, and explore revolutionary aeronautical concepts. Each ARMD program (Aviation Safety and Security, Airspace Systems, and Vehicle Systems) incorporates enduring, strategic technical focuses, including environmentally friendly (clean-burning engines), new aircraft energy sources and management, quiet aircraft for community-friendly service, and aerodynamic performance for fuel efficiency and community access, aircraft weight reduction and durability, smart aircraft and autonomous control.

The 1997 roadmap was a good baseline from which to start, although UAV were not in the mix then. The roadmapping team met in Chicago and used expert input to devise a rough set of plans, which will go to the Advanced Planning and Integration Office (APIO). They are trying to build the tools to reach out to the wide community to assemble this roadmap and are asking stakeholders (system users) to focus this effort—e.g., should they work on a 1% improvement in emissions, or on safety, or on a new capability? The portfolio has been analyzed at various budget levels, and ARAC will meet May 26–27 to complete phase I and will proceed as planned with phase II.

The APIO established time frames: Phase I, the Digital Era—2005–2015; Phase II, the Sentient Era, 2015–2025; phase III, the Nano-Bio Era, 2025–2035. For each time frame, they have plotted projects that address safety, security, environment, capacity, mobility, and new missions. However, this roadmap is a working paper and is open for discussion.

Lastly, the ARMD roadmap must be integrated with the rest of the Agency. The strategic roadmap is key to conveying that air transportation is important to the health of the United States and that major, coordinated transformations must take place over the current state of the art; to demonstrate that NASA provides a solid foundation for US aeronautics; and to assist ARMD and the research centers in meeting the challenges that face us. Mr Hertz recommends creating a fifth subcommittee for this body to help provide advice on the roadmap. The most recent roadmap will be posted on the ARAC Web site (<<http://www.aero-space.nasa.gov/>>).

Discussion

Dr Hansman and Mr Swanda suggested that a utility function workshop might be useful to establish priorities. Mr Hertz assured them that, rather than a single utility structure, several functions will be factored into the analysis. They do not expect stakeholder concurrence; they are just asking what stakeholders, as travelers, think is important. Data received (they will ask OMB, staff, members of Congress, et al) will give the functions to put into the analytical tools to enable prioritization. If the trial being done today is not productive, it will be adjusted. Mr Jamieson and Dr Gellman said they tried to implement this approach in Chicago, and that it can be done without the utility functions' being fully operative. Results could be given to graduate students. This roadmap won't go to the National Academies for an independent review.

Mr Jamieson sees that a lot of good work has been done, and he doesn't see it as ending; it should be continued by a standing subcommittee, which would not be a FACA committee, at least at first. (A committee that currently has FACA status does not necessarily have FACA status for future work.) Mr Hertz agreed that members have to provide the new subcommittee with NASA work to ensure that that work is coincident with JPDO, and then decide what is NASA-owned. Several people asked whether the proposed subcommittee should wait for the new Administrator to speak before they proceed, eg, the military could be included in the strategy. Dr Lebacqz thought the issue for aeronautics is mission integration, which is what the Administrator had noted was not being done. Dr Griffin thinks there should be a national policy. Dr Lebacqz hopes the program Mr Wletzien has outlined will be the model for this. However, Dr Lebacqz said that, if policy does not change, ARMD, using the 1997 roadmap as a starting point, has a program that will work. (Although, a stated policy limits directors' flexibility.)

Mr Kern and Mr Wilke thought it was important to get the right people from the right organization to build on what's already been done. Mr Anderson agreed that this is a critical activity that should be ongoing. Now, there is lack of clarity of what the core issues are. Mr Frisbie saw the problem as identifying the audience. The document has to be on a high enough level to articulate a roadmap that is in concert with the national plan.

Ms Bauerlein said that, in 1997, the FAA collaborated but for a NASA objective, whereas, the FAA is truly involved in this effort. Nick Sabatini has been invited to participate, but he was unable to do so; Mr Hertz will provide the name of the FAA person who will participate.

Mr Swanda observed that NASA seems to be constantly roadmapping and never building a road. But, Mr Hertz said, that environment is changing: in 1997, no one ever talked to anybody, and a nosedive started in 1998. Dr Lebacqz and Mr Anderson noted that this roadmap was begun with the previous Administrator, and the current Administrator says the process should be stopped. Nevertheless, there is value in defining a plan. Mr Hertz thought that what has been missing is a national plan so that policy has, in effect, been set by the budget. Currently, space exploration has a presidential directive; JPDO does not.

In selling ideas, Dr Weber has learned that people tend to spend all their time on WHAT and HOW—what to do and how to do it. But people care about WHY something is being done. Investors want to hear what need is being fulfilled; they assume you will figure out how to do it. This meeting has focused on programmatic method and process (how), which gives leverage to take the ideas to OMB. This is important work, but in communicating need, at least half of the communication has to be why the research or technology is important. This is an overarching observation that is critical to the existence of the organization. In answer to the question, “Why?” you can’t just say a report said to do it. You have to engage the audience emotionally so they agree that what you want to do is important. Dr Lebacqz agreed, saying that the argument for a national policy addresses this issue. NASA is composed of people who are absolutely committed to the idea that aeronautics is important, fundamental, and exciting and should be funded. As such, NASA “preaches to the choir.” Somewhere in between the grand vision (which is exciting) and the programmatic end, is a necessary translation.

Mr Kern said NASA has to be able to tell a story. This is easy to do in business, but it’s tougher in Washington, DC, which “is like a moving craps game”—it’s different from any other business. The story you have to tell is different for each constituency, different from your boss, different from each other faction. So there are 100 versions of the same stories. And you really never know what the constituency’s motives are. It’s a good idea to have a roadmap that shows relationships among various agencies and other groups. But, Dr Lebacqz cautioned, we don’t necessarily have a cohesive group.

JPDO Status and 2025 Concept—Doug Arbuckle

The Joint Planning and Development Office’s (JPDO) 8 Integrated Product Teams (IPT)—Airport Infrastructure, Aviation Security, Air Traffic System, Situational Awareness, Environmental Protection, Weather, Global Harmonization, and Safety Management—were asked to devise a plan for where we should be in 2025. This has been dynamic—something to shoot for and to shoot at—which changes about twice a week. At this point, the 2025 targeted broad-area capabilities are: global access to net-centric information, airborne information web, broad-area precision navigation, required total system performance, 4-D trajectory management, “dynamic airspace” configuration, weather information assimilation into ATM decision loops, “equivalent visual” operations, and “super density” operations. For each capability, the Next Generation Air

Transportation System (NGATS) team will lay out a migration path as to where we are and where we want to be in 2025. These are not necessarily satellite solutions, but a constellation in the atmosphere or in space. They envision far fewer facilities than we now have, assuming that power and other services can be provided in a single facility at a distance. It is not possible to foresee all uses of these capabilities, but JPDO will meld inputs from various places to provide network-enabled operations, which gives common awareness of ongoing operations, events, and crises (the driver). Security will be driven by needs and priorities.

The net-centric operations theme is, “It’s about the users”; not about, “The system won’t let you do that.” Concepts of command and control change when you move into this environment, and aviation culture is not used to this—aviation culture likes order and control to keep people safe. Net-centric operations are assumed to give increased collaboration, but also increased gaming, which calls for a fair amount of R&D. Net-centric information-sharing themes are see, comprehend (most important), and enable action. Implementing network-enabled capabilities requires collaborative effort in technology, organization, culture, and policy. In this, DoD is about 5 years further ahead than everyone else. UAV will be in the system in 20 years. This is a performance-based system, which allows people flexibility in how they comply and assumes contracts between service providers and users. Airspace must be designed to accommodate trajectories.

Executive order 13356 mandates information sharing, and the NGATS is built around information sharing. The projection for 2025 is based on assumptions of sufficient bandwidth, sufficient infrastructure, broad-area precision navigation, secured according to the users’ needs, and push/pull information sharing via NEO. Cooperative surveillance—aircraft and others broadcast their state and intent and identify cooperative and non-cooperative targets. This information will be available to the public so they can respond to options when flights change.

More separation assurance and management is being performed by the aircraft, which raises 2 issues: What are the best roles for automation and humans? And, what are the best roles for aircraft operators and service providers? The framework would give a single mechanism for implementing all geospatial information. Flocks of planes could be created and disbanded as needed, creating high-density airspace that expands and contracts. But to achieve dynamic airspace configuration, you need all information in a common 4-D geospatial information system (GIS) with which airspace could be configured hourly in response to traffic. The NGATS team has devised the “Evaluator” to post and update 4-D trajectories in a common system and integrate and communicate information on weather, security, defense, and non-US entities. The system looks for mutual compatibility of all elements and will be available for all to see. Users will be encouraged to resolve resource conflicts in a distributed decision-making environment, but a final arbitration mode will be possible for the service provider.

Discussion

Dr Hansman observed and Mr Arbuckle agreed that, as for precision of information in the future, information becomes probabilistic, and beyond 60 minutes you may be wasting your time; 20 to 60 minutes is the range, which presents a design issue for how to transition from one to the other.

The Evaluator, Mr Arbuckle explained, is an information automation environment that has all the information in it, with humans looking at the particular window of interest. Dr Hansman said that these things are designed for the worst-case scenario, but here automation gives possible solutions from which a human can select. If enough crises occur at once, Mr Arbuckle said, you take the system down to a lower performance level, and do not leave that decision to a machine. Envision a solution as a set of responses and options.

In response to Dr Gellman, Mr Arbuckle said that the significance of 330 days is that no carrier is known to schedule further into the future than that, but that time horizon could be set at any value.

Corporate Management of Facilities—Blair Gloss

ARAC recommended that Code R should take steps to make management of facilities more efficient. Using information from the RAND study and Strategic Aerospace Capabilities Team, ARMD devised the following approach with the goal of increasing the probability that NASA will have the facilities they need over the long term. They implemented the Aeronautics Test Program (ATP) and began with NASA/DoD National Aeronautics Test Alliance (NATA) sites, namely Glenn Research Center, Langley Research Center, and Ames Research Center. For each facility they developed budget guidance for FY2006 and 2007, categorized all wind tunnels, and developed an investment strategy for each category of wind tunnel, including facility maintenance (large items are not covered by pricing), facility upgrades and test technology, and facility-related research, primarily at universities. They divided wind tunnels into 5 categories:

Category I: Tunnels for which NASA assumes stewardship—Ames Unitary, Glenn Icing Tunnel, Glenn 9x15, and Langley NTF.

Category II: Facilities for which other people have requirements and for which ARMD would ensure the availability of facilities through 2007; they will be put on standby, including a small group to maintain them when not in use—Langley TDT, Langley Hypersonic Complex, Langley 21-ft Vertical Spin Tunnel, Langley 14x22, Langley 8-ft HTT, Glenn Propulsion Systems Lab 3 & 4, and Glenn Unitary, 10x10-ft supersonic.

Category III: Facilities not required now and those that haven't been used for a while will be "put in mothballs" (proper steps have been taken to take fluids out or in; they are inspected occasionally to be sure the roof doesn't leak, etc. To get a mothballed facility

back on line would take about a year.)—Glenn Hypersonic Test Facility at Plumbrook and Ames 12-ft Subsonic Pressure Tunnel.

Category IV: Facilities that are not being used and will not be needed in the future will be closed, mothballed, or operated safely under full-cost recovery policy—Langley 16-ft Transonic Tunnel [closed]; Ames National Full-scale Aerodynamic Complex [transferring to the Air Force]; Ames 7x10 (2 tunnels); Langley 22” Mach 20 [closed]; Langley Low-Turbulence Pressure Tunnel (LTPT, which is in very poor repair); and Langley Unitary (capability exists elsewhere).

Category V: Laboratories that should not be included in ATP and for which no ATP funds will be provided—Glenn Aero-Acoustic Propulsion Laboratory, Langley 0.3-m Transonic Cryogenic Tunnel; Langley Jet Exit Facility; Langley 20-inch Supersonic Wind Tunnel.

Categories IV and V are funded elsewhere, except for LTPT. ATP is implementing office; assessing and proposing cost and pricing structure; developing a facilities investment and divestment plan, overall marketing strategy, and consistent operations policy; proposing university research activity; and initiating discussion with facility customers. For example, they have started to discuss NASA corporate management facilities with DoD (but there’s more than 1 DoD). The ATP team wants input from ARAC on the best ways to communicate ATP activities to the industry, and thoughts on which facilities should be maintained and how to manage facilities that are national assets—we need a process that will allow people who need these facilities to help maintain them.

Discussion

Mr Gloss said wind tunnels were categorized by NASA ARMD working with DoD. This information is in preliminary discussion throughout DoD and some of industry. Mr Harris said the ROME contract has been awarded and Langley is in the process of transitioning to a complete contractor-operated facility. The question to resolve, said Mr Gloss, is whether we want all these centers to be contractor operated.

Mr Boccardoro suggested formally factoring into the categorization, uniqueness of the capability—a uniqueness premium. He stressed that across the country we need capability and proficiency. Dr Lebacqz said that an NST subcommittee also has a working group (of which Mr Gloss was a member).

But, the bottom line is that ARMD will have \$200 million less to support the programs, so we have to prioritize them and be sure we identify the ones the country really needs. So far, 9 have been identified as critical. Dr Hansman and Mr Gloss thought that cutting programs to accommodate the budget would bring forward people who disagree, and then adjustments can be made as necessary. For tunnels that are commercially but not programmatically viable, NASA needs to develop a process that involves NASA, DoD, and industry.

Mr Gloss clarified that NASA has sufficient budget to operate categories I and II and to “mothball” category III facilities. “Closed” means the door is locked and there’s no heat or electricity (“demolished” would be a category below that). The facilities could be given to the General Services Administration (GSA) to be put out as surplus. To return to operation from standby takes weeks, and who would pay those associated costs has not yet been factored in. If something breaks, there are no internal funds to deal with it. Mr Anderson reported that Boeing uses 2 alternatives, one of theirs and one abroad. Mr Frisbie suggested splitting Category I into Ia and Ib because Ia is really the priority.

Gen Hoover, Dr Lebacqz, and Dr Gellman pointed out the need for alternative funding mechanisms to get out of the business of owning these facilities, eg, the state of Ohio may assume ownership in exchange for use. We also need to consider how to build tunnels that will be needed in the future. It might be possible to find a lessor for 10 years and let people lease a wind tunnel; let the free market operate. Mr Kern suggested publishing such messages in the *Federal Register*, asking for a business plan or ideas from the community. With the *Federal Register*, you’re asking the community if we missed something, and asking the business community if anyone has a need for this capability. But, Mr Gloss noted that first DoD would first have to agree on that process.

In response to Dr Gellman, Dr Lebacqz said the ramifications of full-cost accounting differ depending on which parts of the Agency you consider. At least NASA is discussing how much these things cost, but priorities remain the same. How NASA’s budget changes will affect FAA projects is not known. Mr Hertz and Dr Lebacqz agreed that, for fewer projects, NASA needs fewer civil servants, but those people have to be paid, so they may get paid from different parts of the Agency. Nevertheless, Exploration Systems decisions are not driven by full-cost accounting.

Council of Deans Report—Nicholas Altiero

All 15 members of the Council of Deans are engineering deans. The council represents a large cross section of universities. To put a mechanism in place so they can speak for the engineering community as a whole, they are identifying objectives, which will be posted. A university strategy will be drafted and given to the council for input, trends and needs for universities and colleges will be summarized, and NASA mechanisms for rewarding researchers assessed. Some universities have never understood how to interact with NASA. The council has scheduled a meeting for September 19 (before the ARAC meets). Their information is available on the Council of Deans Web site:
<<http://www.aeronautics.nasa.gov/aboutus/advisors/cod/index.htm>>.

Discussion

Dr Lebacqz and Dr Hansman find the issue of university/NASA interaction and cooperation critically important. Thinking should focus on the new assistant professor level, not the dean level. Because of the richness of technology that goes into aerospace,

Dr Gellman cautioned that the council should not overlook universities that do not have an aerospace department.

Mr Boccardoro noted that NASA already has good interactions with some universities. Dr Lebacqz noted that this process requires 2-way communication. At the university, Dr Katehi said, professors worry about placing graduates and whether there is enough need for those graduates. All of these areas tend to be lumped together, but specialization can cause be a problem if a focus in space research shifts before students' training is complete. Mr Boccardoro said that at the other end of the spectrum, the biggest worry for Northrop Grumman is finding more qualified people.

The FACA portion of the meeting adjourned at 4:45

NASA Aeronautics Research Advisory Committee

Non-FACA* Session

ARAC Executive Secretary Green invited members to give concerns, findings, or recommendations based on the day's 7 presentations and discussions.

As a result of a discussion with Charlie Keegan, Dr Lebacqz requested that ARAC conduct a review with a research engineer. Mr Jamiesen noted that the JPDO is supposed to be setting a target, which is in flux because JPDO's goals are still fluid, but there must be alignment between the target and the programs. Dr Hansman thought IPT members should begin by stating the requirements as they see them (this could be done in a 2-day meeting). A subcommittee could focus on air-space systems. But, cautioned Mr Jamiesen and Mr Green, a request for a review must be given with a known, desired end: Would it be looking for consistency, overlap, or redundancy? Would it be a technical review of what they're working on, or a strategic review? Dr Weber and Mr Frisbie concurred: JPDO (the nation's bet on aeronautics, which was constituted by a NASA research program and an FAA research program) is generating ideas without a lot of technical supervision or review. Many people are giving opinions; the question is alignment. Therefore, it's a legitimate argument that this key part needs to be reviewed. Mr O'Brien and Dr Lebacqz pointed out the precedent for this approach in the joint *ad hoc* groups that review programs looking for duplication and whether work was accomplished in a manner that best suits the users' needs. As such, a request for review would be a follow-on to what has been done before and would include letters of reference, legislation, review, and prioritization of work. Timing is also a question, although it may still be too uncertain to be useful. Moreover, if such a report is too long and bureaucratic, it won't work. Mr Jamieson suggested that ARAC report back at the September meeting with advice to NASA and JPDO, which can factor it into the decisions being made, and would function more as an oversight. The review could be done during the scheduled meetings, or a snapshot review could be done over the summer.

Mr Frisbie and Dr Hansman said that JPDO was in the process of identifying impediments they thought would refocus R&D. They have a short list of perennial obstacles to getting more capacity, and they might have a list of things they want to prioritize. There may also be a mismatch of required skills. However, the Evaluator may be an expensive way to devise a set of rules on how to do that. Mr Jamieson, Mr Green, and Dr Lebacqz assured the members that each subcommittee in its programmatic area will conduct a review and report back to the group. There are 3 subcommittees and there will be a new subcommittee of this committee and a task force, which need to meet anyway. Impediments and priorities should be a topic. Mr Hertz, Dr Hansman, Dr Weber, and Dr Katehi suggested that a designee and the chair meet with the 3 subcommittees

* Federal Advisory Committee Act

(safety, air space, and vehicles) with REDAC members, and then adjust as necessary. “Review to get alignment” is too broad; ARAC members should list 3 or 4 questions to review against, and the desired goal.

Mr Kern and Dr Hansman summarized by saying that eventually JDPO has to develop a process, and encouraged ARAC to help JPDO defend their position. This information would also be helpful for NASA.

Concerns to Be Raised at the NAC

ARAC Chair Jamieson asked members to state particular items of concern that should be raised at the NAC:

Strategy

Dr Hansman asked what NASA’s strategy in aeronautics would be.

FAA Role

Mr Kern saw a need for everyone to clearly understand that the FAA is out of the research business, and therefore the FAA director should proclaim that NASA is the FAA’s official research arm.

Proprietary Research

Dr Gellman asked whether US scientists will pursue a course of maintaining NASA’s research results as proprietary information, as the Europeans do. Dr Gellman thinks if NASA did that for a few years, the Europeans would change. People in this Administration think that, if the World Trade Organization (WTO) case resumes, it will level the playing field, but such a course would take 4 years, and the value of aeronautics is so great that the United States can’t wait that long.

Education

Dr Katehi brought up the issue of national skills and education. Dr Hansman is concerned that universities won’t have faculty members in the field of aeronautics because graduate students think it’s a dead end; then the faculty won’t have students, and so on. Dr Katehi is seeing this already. Dr Gellman said the engineers’ unions are also very concerned about this, and suggested that the unions could be added to the mix of those who would support education of engineers to benefit the future of aeronautics. One of the things that makes engineers less useful than they ought to be is that they don’t understand their environment. Unemployed engineers are unemployable because government uses the cash accounting system, but everyone else uses the accrual accounting systems, and the engineers only know how to operate in one or the other environment. Dr Lebacqz suggested initiating more interagency interaction to address this.

National Policy

Mr Anderson noted that interest is rising in many quarters for a national aeronautics policy. He wondered whether it would be appropriate to ask the NAC for this. Dr Gellman thought it interesting to consider this in light of the question: “Has lack of national energy policy hurt us?”

Earmarks

Mr Frisbie asserted that earmarking bedevils NASA employees by inhibiting their ability to do what they plan. Mr Anderson countered that NASA has to accept earmarking for what it is—a guerilla campaign conducted because people aren’t getting what they need otherwise, and this is the only way they can get it. Dr Lebacqz thought that, to be fair, this was an unusual budget year: the budget went to an omnibus bill, so all the earmarks in the House and the Senate were added together. However, he agreed that earmarks indicate that people are frustrated with the way money is allocated. Dr Katehi said that many universities use earmarks because the states are failing them, and politicians themselves are using them and saying this is the way to do things. Dr Weber said that her university competes well on a merit-based system, but this Administration is “giving out earmark money like candy” and that any university that doesn’t go after earmark money is “leaving money on the table.” Mr Frisbie suggested that NASA should assume that they will get only 70% of the money budgeted (after subtracting the 30% for earmarks).

Economic Impact Statement and the Business Community

Dr Weber pointed out that reporting economic impacts is one approach that has always been successful. If aeronautics could assess the potential economic impact of an action or inaction, it could have huge implications for Congress and OMB. Space Exploration doesn’t allow concern about the cost, so aeronautics, in a sense, is the only leg that can influence cash flow. She encouraged NASA to make a business case for areas of research that are at risk, and then make that business case one of the flagship pieces of the presentation. Mr Kern reported that, at a meeting of Chambers of Commerce, they had talked about the business community’s needs for an effective aeronautics community—and the Chambers of Commerce supply data to their 3 million members. Their concern is that, if airlines fail or are re-regulated, it will adversely affect business. Dr Harris doesn’t understand how aviation is not already in a crisis situation in terms of efficiency and competitiveness.

Industry

Gen Hoover, Dr Katehi, and Dr Gellman wondered what industry’s CEO should be contributing in response to OMB’s statement that this year they had no input from industry. Support from industry is critical.

Other Issues

Dr Lebacqz said the 2006 budget has been submitted by the President and is being debated by Congress. But, Congress is unhappy with the NASA budget submission and wants to return \$54 million to aeronautics—they even talk about having a real authorization bill.

ARAC, May 3, 2005

Dr Weber and Dr Hansman wondered about the best approach. Could Dr Lebacqz ask Dr Griffin, “What can I help you do to sell aeronautics?” Or, could he say, “Of this, this, and this, which helps you sell aeronautics best?” They stressed the need to communicate. Dr Lebacqz pointed out that the pivotal issue is not the public or the Congress.

Adjourned at 5:35

Appendix

Agenda

Aeronautics Research Advisory Committee (ARAC)
NASA Headquarters, Conference Room MIC 6 (6H46)

May 3, 2005

8:30	Review Agenda, Introduce New Members & Discuss Logistics	Green
8:45	Opening Remarks	Jamieson
9:00	NASA Aero FY06 Budget Update	Lebacqz
10:30	Break	
10:45	Joint Planning and Development Office Update	Keegan
11:45	Lunch—On your own.	
12:45	Vehicle Systems	Wlezien
1:45	Integrated Product Team (IPT)	Arbuckle
2:30	Aeronautics and Roadmapping Update	Hertz
3:15	Break	
3:30	Corporate Management of Facilities	Gloss
4:15	Council of Deans Report	Altiero
4:45	Non-FACA Recommendation Drafting Session	Green
5:30	Adjourn	
6:00	Cocktails/Dinner 410 First Street SE 202 543-5005	Bullfeathers

People Who Attended the Meeting

NASA

Rose Ashford, Ames
Vicki Crisp, LaRC
Robert Ferguson
G Michael Green, ARMD
Terrence Hertz
Victor, Lebacqz, ARMD
Herman A Redress, HQ
Vicki Regenie, APIO
Jaiwan Shin, ARMD
Jennifer Trokell, OER
Chas Willets, HQ
John White, HQ
Richard Wlezien, HQ

non-NASA

James M Jamieson, *Chair*, Boeing
Nick Altiero, Tulane University
Mark Anderson, Boeing Phantom Works
Charles Boccadoro, Northrop Grumman Corp [alternate for Paul Marchisotto]
Joan Bauerlein, Federal Aviation Administration
William Berwin, AFRL
William Borger, Wright-Patterson AFB
Philip Carrigan, Raytheon [alternate for Bob Eckel]
Frank Frisbie, APPTIS
Aaron Gellman, Northwestern University
R John Hansman Jr, MIT
Vascar G Harris, Tuskegee University
William W Hoover, NRC, *ex officio*
Jim Jamieson, Boeing
Leonard Jaffe, consultant
Linda Katehi, Purdue University
John Kern, Federal Aviation Administration
John O'Brien, consultant [formerly Air Line Pilots Assn]
Tony Springs, Northrop Grumman Corp
Ronald Swanda, General Aviation Manufacturing Association
Tony Toulouse, Boeing
Mary Ellen Weber, University of Texas
Clifford Wilke, Department of Homeland Security [alternate for Randy Null]

Material Distributed at the Meeting

Aeronautics Research Mission Directorate [Lebacqz]

Update on Next Generation Air Transportation System [Pearce]

Next Generation Air Transportation System Integrated Plan [Mineta & Blakey, 12/12/04]

Transformation of the Vehicle Systems Program [Wlezien]

Aeronautics Research Strategic Roadmap Overview [Hertz]

JPDO Status and 2025 Concept [Arbuckle]

Corporate Management of Facilities [Gloss]